

**CLAIM AMENDMENTS**

Amend claims: Canceled Claims 1-10.

11. (New) A drilling system for drilling a bore hole into an earth formation, the bore hole having an inside wall, and the system comprising:

- a drill string reaching into the bore hole from a surface, leaving a drilling fluid return passage between the drill string and the bore hole inside wall;

- a bottom hole assembly supported by the drill string;

- a drilling fluid discharge conduit in fluid communication with the drilling fluid return passage;

- pump means for pumping a drilling fluid through the drill string into the bore hole and to the drilling fluid discharge conduit via the drilling fluid return passage;

- means for obtaining information on the existing down hole pressure of the drilling fluid in the vicinity of the bottom hole assembly;

- back pressure means for controlling the drilling fluid back pressure;

- back pressure control means for controlling the back pressure means, wherein the back pressure control means comprises a programmable pressure monitoring and control system arranged to receive the information on the existing down hole pressure, calculate a predicted down hole pressure using a model, compare the predicted down hole pressure to a desired down hole pressure, and to utilize the differential between the calculated and desired pressures to control said fluid back pressure means.

12. (New) The system of claim 11, wherein the back pressure means comprises pressurizing means.

13. (New) The system of claim 11, wherein the back pressure means are arranged to control the discharge of drilling fluid from the drilling fluid return passage.

14. (New) The system of claim 11, wherein the back pressure means comprises a variable flow restrictive device arranged in a path for the flow of drilling fluid downstream

of a point where the injection fluid supply passage connects to the drilling fluid return passage.

15. (New) The system of claim 11, wherein the means for obtaining information on the existing down hole pressure of the drilling fluid in the vicinity of the bottom hole assembly comprises a pressure-sensing tool located in the bottom hole assembly.

16. (New) The system of claim 15, further comprising a down-hole telemetry package for transmitting data gathered by the pressure-sensing tool to the surface.

17. (New) The system of claim 11, wherein the means for obtaining information on the existing down hole pressure comprises

- an injection fluid injection system comprising an injection fluid supply passage fluidly connecting an injection fluid supply with the drilling fluid return passage; and

- an injection fluid pressure sensor arranged to provide a pressure signal in accordance with an injection fluid pressure in the injection fluid supply passage.

18. (New) The system of claim 17, wherein the injection fluid pressure sensor is provided on or close to the surface.

19. (New) The system of claim 17, wherein the fluid injection means is arranged to inject an injection fluid having a mass density different from that of the drilling fluid, preferably the injection fluid having a mass density that is lower than that of the drilling fluid.

20. (New) The system of claim 17, wherein the injection fluid supply passage is in fluid communication with the drilling fluid return passage in the vicinity of the bottom hole assembly.

21. (New) The system of claim 11, wherein the bottom hole assembly is provided on a lower end of the drill string.

22. (New) The system of claim 11, wherein the programmable pressure monitoring and control system comprises a personal computer based SCADA system.

23. (New) A drilling system for drilling a bore hole into an earth formation, the bore hole having an inside wall, and the system comprising:

- a drill string reaching into the bore hole leaving a drilling fluid return passage between the drill string and the bore hole inside wall;

- a drilling fluid discharge conduit in fluid communication with the drilling fluid return passage;

- pump means for pumping a drilling fluid through the drill string into the bore hole and to the drilling fluid discharge conduit via the drilling fluid return passage;

- a bottom hole assembly supported by the drill string, the bottom hole assembly comprising a down hole sensor and a down hole telemetry system for transmitting data, including down hole sensor data, the down hole sensor data at least representing down hole pressure data;

- back pressure means controlling the drilling fluid back pressure;

- back pressure control means controlling the back pressure means, wherein the back pressure control means comprises a programmable pressure monitoring and control system arranged to receive the down hole sensor data, calculate a predicted down hole pressure using a model, compare the predicted down hole pressure to a desired down hole pressure, and to utilize the differential between the calculated and desired pressures to control said fluid back pressure means, and wherein the programmable pressure monitoring and control system is arranged to compare the predicted down hole pressure with the down hole sensor data.

24. (New) A method of drilling a bore hole into an earth formation, the bore hole having an inside wall, the drilling method comprising the steps of:

- deploying a drill string from a surface into the bore hole and forming a drilling fluid return passage between the drill string and the bore hole inside wall, the drill string supporting a bottom hole assembly;

- pumping a drilling fluid through the drill string into the bore hole and via the drilling fluid return passage to a drilling fluid discharge conduit arranged in fluid communication with the drilling fluid return passage;

- obtaining information on the existing down hole pressure of the drilling fluid in the vicinity of the bottom hole assembly;

- feeding the information of the existing down hole pressure into a model;

- calculating a predicted down hole pressure using the model;

- comparing the predicted down hole pressure to a desired down hole pressure;

- controlling a drilling fluid back pressure by controlling back pressure means utilizing the differential between the calculated and desired pressures to control said fluid back pressure means.

25. (New) The method of claim 24, wherein obtaining information on the existing down hole pressure of the drilling fluid in the vicinity of the bottom hole assembly comprises pressure-sensing.

26. (New) The method of claim 25, wherein the pressure sensing is performed by a pressure-sensing tool located in the bottom hole assembly.

27. (New) The method of claim 26, further comprising transmitting the data gathered by the pressure-sensing tool to the surface.

28. (New) The method of claim 24, wherein obtaining information on the existing down hole pressure of the drilling fluid in the vicinity of the bottom hole assembly comprises:

- injecting an injection fluid from an injection fluid supply via an injection fluid supply passage into the drilling fluid in the drilling fluid return passage;

- generating a pressure signal in accordance with an injection fluid pressure in the injection fluid supply passage.

29. (New) The method of claim 28, wherein the injection fluid is injected in the vicinity of the bottom hole assembly.

30. (New) The method of claim 28, wherein the model includes taking into account a pressure difference of the drilling fluid in the drilling fluid return passage in a lower part of the bore hole stretching between the injection fluid injection point and the bottom of the well bore.